

# KEY TO THE SPECIES OF LIVERWORTS RECOGNIZED IN THE SIXTH EDITION OF GRAY'S MANUAL OF BOTANY.

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This key may be considered as a continuation of the one published last year in the Ohio Naturalist (Vol. V, p. 312.) Its purpose is therefore the same; it is intended to make the study of the liverworts and their determination more easy. It was thought to be necessary to put into the key more characters than are usually given. Rather than hamper the student in any way in his efforts to determine the liverworts, this extended key is believed to enable him to overcome the obstacles in his path.

*Aneura* Dumort.

1. Thallus narrow (about 2 mm. wide), palmately and pinnately divided or pinnate or bipinnate. 2. Thallus wider (4 mm. wide or more), simple or irregularly lobed. 4.
2. Calyptra smooth, not tuberculate, more or less hairy or squamulose, obovate-pyriform, about 3 mm. long. *pinnatifida* Nees. Calyptra more or less verrucose or tuberculate. 3.
3. Thallus biconvex with wide margin, formed by a single layer of cells (therefore in transverse section lens-shaped; calyptra cylindrical, 6-8 mm. long. *multifida* Dumort. Thallus flat, pellucid, with narrow margin (in transverse section of nearly equal thickness or planoconvex); calyptra pyriform-clavate. *latifrons* Lindb.

4. Thallus simple or slightly lobed; involucre short, lacerate; pedicel not folded upon itself. *punguis* Dumort.

Thallus irregularly lobed; involucre none; pedicel 16–25 mm. long, sometimes folded upon itself and remaining within the calyptra, the capsule thus appearing sessile. *sessilis*, Spreng.

*Anthoceros* Micheli.

Thallus papillose; spores black, strongly muriculate and sharply angled. *punctatus* L.

Thallus smooth; spores nearly smooth, yellow, angular. *laevis* L.

*Asterella* Beauv.

Thallus forking and increasing by joints. Antheridia in sessile lunate disks. Peduncle bearded at base and apex. Spores large, tuberculate, nearly reticulately folded.

*hemisphaerica* Beauv.

*Bazzania* S. F. Gray.

Plant robust; leaves from green to brownish, about 2 mm. long, somewhat deflexed with concave base, their apex 3-toothed; underleaves roundish-quadrangular, 4–6 toothed above and sinuate on the sides. *trilobata* S. F. Gray.

Plant much smaller; leaves yellowish or dark brown, about 1 mm. long, strongly deflexed, perfectly convex, their apex 2–3 toothed or entire; underleaves suborbicular, bifid, crenate or entire. *deflexa* Underw.

*Blasia* Micheli.

Thallus simple or forked or stellate, with sinuous margin; fruit from an oval cavity in the costa; involucre mostly none; capsule oval-globose; gemmae globose in flask-shaped receptacles; the scale-like underleaves broad-oval, coarsely dentate, in one longitudinal row. *pusilla* L.

*Blepharostoma* Dumort.

Stem flaccid, creeping, branched; leaves much smaller than the ramose, forking and awl-shaped involucral leaves; perianth ovate-cylindric. *trichophyllum* Dumort.

*Cephalozia* Dumort.

1. Perianth more or less 3-angled or 3-carinate; leaf cells large (mostly 25–50  $\mu$  broad;) plants medium sized. 2.

Perianth 3–6 angled; leaf cells small (14–20  $\mu$  broad); plants small, often minute. 7.

2. Underleaves rarely present, except on fruiting branches. 3.

Underleaves usually present; leaves rarely subimbricate.

*fruitans* Spruce.

3. Leaf lobes straight. 4.

Leaf lobes connivent or incurved. 5.

4. Dioecious, rarely monoecious; without runners; usually pale; leaf cells opaque; perianth large, widest above middle, unequally ciliolate. *virginiana* Spruce.

Monoecious; with runners; usually greenish or reddish; leaf cells pellucid; perianth linear-prismatic or fusiform, whitish, denticulate or ciliate. *bicuspidata* Dumort.

5. Leaflobes narrow, incurved. *curvifolia* Dumort.

Leaflobes broad, short, connivent. 6.

6. Leaves decurrent; perianth linear-fusiform, 3-plaited, when young triangular only above, when mature. *multiflora* Spruce.

Leaves not decurrent; perianth large, oblong-cylindric, obtusely angled. *planiceps* Underwood.

7. Growing on the ground and on rocks; heteroecious; perianth linear or narrowly fusiform, prismatic, denticulate or subentire; leaves somewhat distant with acute lobes and an almost rec-

tangular acute sinus; underleaves often on sterile stems as also on fruiting branches. *divaricata* Dumort.

Growing on rotten wood; dioecious; perianth broadly oval to ovatefusiform. 8.

8. Perianth small, whitish, obovate or ovate-fusiform, obtusely 3-angled, the mouth setulose or ciliate; leaves with a broad or lunate sinus and broad-subulate, mostly acute lobes.

*Macounii* Aust.

Perianth broadly oval or subobovate, obtusely angled, the apex slightly plicate, the mouth connivent, dentate, sometimes narrowly scarious; leaves imbricate, more or less serrate, the sinus and lobes subacute; underleaves present.

*Sullivantii* Aust.

*Chiloscyphus* Corda.

1. Underleaves 4-parted; involuclal leaves 2-cleft; perianth 2-3 lobed, the lobes long and lacerate-toothed.

*ascendens* Hook. and Wils.

Underleaves bifid. 2.

2. Involuclal leaves 2-toothed; perianth 3-lobed, the lobes spinose-dentate.

*pallascens* Dumort.

Involuclal leaves slightly 2-toothed; perianth 3-lobed, the short lobes nearly entire.

*polyanthos* Corda.

*Conocephalus* Neck.

Thallus dichotomous, reticulate and porose. Antheridia imbedded in an oval disk, sessile near the apex of the thallus. Spores large, muriculate, brown. Dioecious. *conicus* Dumort.

*Diplophyllum* Dumort.

Stem ascending, nearly rootless; leaves closely folded and subdenticulate, with or usually without a pellucid line near the base, the lobes obtuse or acutish, the lower oblong-scymitar-shaped, coarsely dentate, the upper smaller, subobovate.

*albicans* Dumort. var. *taxifolium* Nees.

*Dumortieria* Nees.

Thallus thin, soft, forking, usually with scattered hairlike rootlets beneath, naked or with a delicate, appressed pubescence above; peduncle chaffy at apex. Spores muriculate. Dioecious. *hirsuta* Nees.

*Fimbriaria* Nees.

Thallus simple or bifurcate, mostly conspicuously porose, with scales below, their hairlike ends surpassing the leafborder in shape of a long white beard. Antheridia immersed in the thallus. Spores roundish-angular, subreticulate.

*tenella* Nees.

*Fossombronina* Raddi.

1. Plant minute; stem forked or fastigiately divided; spores pale fuscous, more or less tuberculate. *cristula* Aust.

Plant large or of medium size; stem mostly simple. 2.

2. Spores brown, depressed-globose-tetrahedral, crested, the slender (16-24) crests pellucid, rarely confluent. *pusilla* Dumort.

Spores reticulated and pitted. 3.

3. Spores yellowish brown, globose-tetrahedral, not depressed, deeply reticulated, the 7-9 reticulations large and deep, 5-6 angled and winged. *angulosa* Raddi.

Spores yellowish to dark brown, globose-tetrahedral, less deeply reticulated, and pitted, the 12-18 reticulations 4-6 angled and indistinctly crenate.

*Dumortieri* Lindb.

*Frullania* Raddi.

1. Perianth smooth; leaves marked by a central moniliform row of cells or by a few large scattered cells; lower lobe cylindric-saccate. 2.

Perianth rough with tubercles or scales or smooth; leaves not marked by moniliform cells; lower lobe helmet-shaped, sometimes expanded, ovate-lanceolate. 4.

2. Leaves orbicular. 3.

Leaves oblong from a narrowed base; lower lobe oblong-galeate.  
*fragilifolia* Tayl.

3. Pinnate; lower lobe near stem, oblong-clavate; underleaves oblong, 2-cleft, flat. *Asagrayana* Mont.

Bipinnate; lower lobe distant from stem, oval or oblong; underleaves quadrate-ovate or obovate, emarginate, margin revolute. *Tamarisci* Nees.

4. Lower leaf lobe about  $\frac{3}{4}$  the size of the upper. *Oakesiana* Aust.  
Lower leaf lobe much smaller than the upper. 5.

5. Underleaves scarcely wider than the stem, bifid, divisions entire, acute. 6.

Underleaves 2-3 times wider than the stem, bifid, divisions entire or toothed, acute or blunt. 7.

6. Perianth pyriform, slightly compressed, repand, smooth, obscurely carinate beneath and gibbous toward the apex.

*Eboracensis* Lehm.  
Perianth broadly oblong, bowl-shaped with very short mouth, papillose, abruptly broad-carinate beneath, 1-many-nerved each side of the keel, 2-angled. *saxicola* Aust.

7. Leaves lax, rather distant, lower lobes mostly expanded, ovate-lanceolate. Sporogonium unknown. *aeolotis* Nees.

Leaves crowded or close-imbricate, lower lobe seldom expanded. Sporogonium known. 8.

8. Perianth tuberculate. 9.

Perianth smooth. 10.

9. Irregularly branching; leaves ovate, lower lobe sometimes expanded into a lanceolate lamina; underleaves not toothed; perianth compressed pyriform, 2-4 carinate dorsally, 4-carinate ventrally. *Virginica* Lehm.

Pinnately branching; leaves round, lower lobe not expanded; underleaves toothed; perianth obovate, retuse. *dilatata* Nees.

10. Underleaves cordate or rounded, sinuate-subdentate; perianth convex dorsally, strongly keeled ventrally. *squarrosa* Nees.

Underleaves rather large, rounded; perianth sulcate dorsally, acutely keeled ventrally. *plana* Sulliv.

#### *Geocalyx* Nees.

Stem creeping with numerous rootlets; leaves ovate-quadrate, bidentate, light to bluish green; underleaves cleft to the middle, with linear-lanceolate divisions. *graveolens* Nees.

#### *Grimaldia* Raddi.

Thallus pale green, purple on the margin and below, with usually distinct whitish pores, the scales beneath often extending far beyond the margin and becoming whitish; peduncle barbed whitish and chaffy at base and apex. *barbifrons* Bisch.

Thallus bluish-green with membranous margins, purple below; peduncle sparingly scaly at base, barbate at the apex.

*rupestris* Lindenb.

#### *Gymnomitrium* Corda.

Stem simple or imbricately branching, thickened at the apex; leaves ovate, bifid, with a narrow scarious margin, bluish-green or brownish- or reddish-yellow to silvery-olive; no underleaves. *concinatum* Corda.

#### *Harpanthus* Nees.

Stem filiform, decumbent, usually simple, leaves roundish ovate, their lobes acute; underleaves large, nearly 3-sided-lanceolate, mostly entire; perianth splitting above on one side.

*scutatus* Spruce.

*Herberta* S. F. Gray.

Stem erect, nearly simple; leaves curved and one-sided, deeply lobed, lobes lanceolate. Perianth ovate-subulate or narrowly fusiform, 3-angled, deeply 4-8 lobed. *adunca* S. F. Gray

*Jubula* Dumort.

Subdichotomously branching; leaves dark olive green, obliquely ovate, acute, entire or subrepand; underleaves roundish, serrate or entire; involucral leaves bifid, serrate; perianth triangular-obpyriform.

*Hutchinsiae* Dumort. var. *Sullivantii* Spruce.

*Jungermannia* Micheli.

1. Leaves complicate-concave, almost always equally bilobed. 2. Leaves not complicate-concave. 4.
2. Stem densely covered with rootlets; leaves distant, oval with obtuse, almost rectangular sinus and acute lobes; involucral leaves 2-3 lobed, spinulose-serrate; perianth ovate, obtuse, the mouth contracted and ciliate. Monoecious.

*Helleriana* Nees.

Stem sparsely covered with rootlets or frequently without any. Dioecious. 3.

3. Leaves erect, spreading, subsaccate at base, their dorsal part far overlapping the stem, subquadrate, with acute sinus, reaching  $\frac{1}{2}$  of the leaf, and acute, often incurved lobes; involucral leaves 2-3 lobed, denticulate above; perianth ovate-clavate, 5-6 plicate above, much contracted and long-fringed.

*Michauxii* Weber.

Leaves very regularly arranged in 2 rows (thus giving the plant a comb-like appearance), keeled, the lobes acute to obtuse; involucral leaves larger, the inner ones trifid; perianth oval-oblong, the mouth somewhat contracted and ciliate-dentate.

*miunina* Crantz.

4. Leaves entire or barely retuse. 5. Leaves 2- or more lobed or -dentate. 7.
5. Underleaves present (not apparent on old stems), broadly subulate; upper involucral leaves lacinate. *Schraderi* Martius.
- Underleaves wanting; involucral leaves like the cauline. 6.
6. Leaves orbicular, decurrent dorsally; perianth exserted, obovate-oblong, the mouth 4-cleft; capsule globose.

*sphaerocarpa* Hook.

Leaves ovate-elliptical; perianth fusiform, plicate above and denticulate; capsule oval.

*pumila* With.

7. Leaves bilobed or bidentate. 8. Leaves 3-6 lobed or dentate, seldom 2-dentate. 16.
8. Underleaves present. 9.
- (*Jungermannia alpestris* and *J. ventricosa* may be sought here)
- Underleaves wanting. 10.

9. Leaves vertical, bifid, the lower leaves with usually acute sinus and lobes, the upper much larger with rounded lobes and obtuse sinus; underleaves entire or the broader bifid; perianth without involucral leaves, dorsal.

*Gillmani* Aust.

Leaves subvertical or spreading, emarginately bilobed, the lobes acute or the upper obtuse; underleaves somewhat obsolete or subulate, incurved; involucral leaves little larger, less deeply lobed; perianth terminal.

*Wattiana* Aust.

10. Leaves 2-toothed. 11. Leaves bifid or 2- 3- or more lobed. 13.
11. Leaf lobes obtuse with an obtuse sinus or acute in the upper leaves; perianth pellucid, reddish below. *Wallrothiana* Nees.
- Leaf lobes acute. 12.

12. Plant green to reddish brown; leaves on the same stem hardly equal to each other in shape, often bearing red globules on the lobes of the upper leaves; perianth whitish. *alpestris* Schleich.  
Plant green to reddish green; leaves on the same stem similar in shape, often bearing yellowish globules on their lobes; perianth green to reddish. *ventricosa* Dicks.
13. Involucral leaves like the cauline; leaves roundish-ovate, 2-lobed with obtuse sinus and inequilateral, obtuse lobes; perianth long-oval to pyriform. *inflata* Huds.  
Involucral leaves unlike the cauline; leaves 2-6-cleft or-lobed. 14.
14. Usually purplish-black; leaves imbricate or distant on erect fertile stems with obtuse, wavy lobes; involucral leaves cristate-undulate, obtusely many-lobed; perianth long-clavate. *laxa* Lindb.  
Light to blackish and purplish-green; leaves horizontal or semi-vertical with acute or obtuse lobes; involucral leaves 3-5 cleft or lobed. 15.
15. Plant small (about 2 mm.), light green often with a purplish hue; leaves semivertical, erect-spreading; upper involucral leaves longer than wide; perianth oblong, pale, often banded and spotted with pink. *excisa* Dicks.  
Plant large (5-15 mm.), deep to bluish green; leaves horizontal, closely imbricate, the upper wavy-crispate; involucral leaves wider than long; perianth oval, whitish green. *excisa* Dicks. var. *crispa* Hook.  
Underleaves none; leaves of irregular shape, 3-or more lobed with obtuse sinus and numerous, wide or narrow, always very acute, dentate lobes, thus giving the plant a crispate appearance. *incisa* Schrad.
- Underleaves present, sometimes obsolete. 17.
17. Leaves divided to  $\frac{2}{3}$  into 3 or 4 acute lobes and coarsely reflexed-dentate at their base; underleaves numerous, deeply bifid with ciliate-dentate base. *setiformis* Ehrh.  
Leaves divided to  $\frac{1}{4}$  into acute or obtuse lobes and not dentate at base; underleaves entire or 2-toothed or often obsolete. 18.
18. Stem often with many vertical shoots, bearing loosely imbricate leaves; perianth oblong. *attenuata* Martius.  
Stem without shoots; perianth ovate. *barbata* Schreb.
- Kantia* S. F. Gray.  
Without ventral runners; underleaves bifid, lobes short oval-triangular, acute or obtuse. *Trichomanis* S. F. Gray.  
With ventral runners; underleaves minute, the upper orbicular, bifid, the lower twice 2-lobed, the primary lobes round-quadrate, the secondary ovate or subulate. *Sullivantii* Underwood.
- Lejeunia* Libert.  
1. Underleaves entire. *clypeata* Sulliv.  
Underleaves bifid or obsolete. 2.  
2. Underleaves bifid. 3.  
Underleaves obsolete; leaves muriculate-denticulate. *calcareia* Libert.
3. Monoecious; stem long, somewhat branching; leaves roundish-ovate, obtuse; perianth obovate-clavate. *serpyllifolia* Libert. var. *americana* Lindb.  
Dioecious; stem filiform, pinnately branching; leaves ovate-triangular, rounded or obtuse; perianth broadly pyriform, 5-carinate. Plant minute. *lucens* Tayl.
- Lepidozia* Dumort.  
Leaves decurved, 3-4 cleft, the lobes lanceolate, formed by more than 2 rows of cells. *reptans* Dumort.  
Leaves incurved, 2-3 cleft or parted, the lobes subulate, formed by 2 rows of cells. *setacea* Mitt.

*Lioclaena* Nees.

Monoecious. Dark Green. Stem with brownish rootlets, closely creeping, usually branched many times; leaves imbricate, mostly decurrent; leaf cells large, roundish, with much thickened walls; involucre leaves vertical and saccate in their lower part, recurved and spread out flatly in their upper part.

*lanceolata* Nees.

*Lophocolea* Dumort.

1. Leaves entire, emarginate and bidentate (often on the same stem), leaves 2-lobed, lobes more or less dentate. *heteropylla* Nees.
2. Underleaves (all) distinctly bilobed. 2.
3. Underleaves 3 to 4 cleft or 2 and 3 to 4 parted. 3.
4. Underleaves 2-lobed. 4.
5. Underleaves 3 to 4 cleft, the inner lobes lanceolate, the outer ones linear; leaves acutely lobed. *bidentata* Dumort.
6. Underleaves, the lower small, 2-parted, the upper larger with a single tooth on each side or palmately 3-4 parted and the apical sublanceolate and narrowly bifid; leaves mostly obtusely lobed. *Hallii* Aust.
7. Leaves 2-lobed with obtuse sinus and lobes or retuse or entire; underleaves light-pink, the steaceous lobes spreading incurved. *Macounii* Aust.
8. Leaves 2-lobed with acute lobes and acute or obtuse sinus. 5.
9. Leaf lobes with an obtuse (lunate) sinus, usually bearing yellowish globules, lobes of underleaves lanceolate, acuminate. Dioecious. *minor* Nees.
10. Leaf lobes usually with an acute sinus; lobes of underleaves sublanceolate. Monoecious. *Austini* Lindb.

*Lunularia* Micheli.

Thallus oblong with rounded lobes, areolate and porose, innovating from the apex, with imbricate sublunate scales beneath; peduncle very hairy; antheridia in the apical sinus of the thallus.

*vulgaris* Raddi.

*Marchantia* Marchant f.

Thallus large, forking, areolate, porose; receptacle divided into an uneven number of rays (mostly 9) and the involucre between them always one less in number. Antheridia immersed in a peduncled, disk-like, raidate, or lobed receptacle. Dioecious.

*polymorpha* L.

*Marsupella* Dumort.

1. Leaves closely and vertically imbricate; stem minute (2-4 mm.), clavate with 4-8 pairs of oval leaves; leaves  $\frac{1}{4}$ - $\frac{1}{2}$  bilobed, lobes acute with an acute or angular sinus. *adusta* Spruce.
2. Leaves spreading or loosely imbricate. 2.
3. Stem stoloniferous, rigid (10-40, sometimes 80-100 mm.), somewhat thickened upward; leaves usually broader than long, subquadrate, lobes obtuse or mucronate; sinus obtuse ( $\frac{1}{2}$  or  $\frac{1}{3}$  of the leaf); the two upper involucre leaves connate to the middle. *emarginata* Dumort.
4. Stem not stoloniferous, erect, subflexuous (15-30 mm.); leaves obovate, their upper half slightly keeled, their lower half ventricose-concave; lobes roundish-obtuse, sinus narrow, acute or less obtuse than in the preceding ( $\frac{1}{3}$  of the leaf); the two upper involucre leaves connate  $\frac{1}{2}$ .

*sphacelata* Dumort.

*Metzgeria* Raddi.

1. Densely villous throughout. *pubescens* Raddi.
2. Hairy on the margin and midrib beneath, smooth above.

2. Midrib covered above and below with 2 rows of enlarged cells; hairs very long, divaricate and hooked-deflexed, the marginal in twos, rarely with discoid tips. *hamata* Lindb.  
Midrib covered above with 2 rows of enlarged cells and below with 3-7 rows of cells. 3.
3. With 3-7 (usually 4-6) rows of cells below, smaller than the upper ones and often indistinct; midrib densely pilose beneath, hairs rather long, straight or nodding, the marginal mostly in clusters of 3-6, some of which have discoid tips.

*myriopoda* Lindb.  
With 3-6 rows of enlarged cells below; hairs rather long, straight, divaricate, the marginal usually in twos, very often disk-bearing.  
*conjugata* Lindb.

*Mylia* S. F. Gray.

Stem erect, nearly simple, radiculose; leaves orbicular, purplish; perianth oval; calyptra finally long-exserted.

*Taylori* S. F. Gray.

*Nardia* S. F. Gray.

1. Perianth exserted, connate with the involucreal leaves, subcampanulate and open, deeply lacinate, 6-10 plicate; rootlets purple.  
*fossombronoides*, Lindb.

Perianth connate at base with the inner involucreal leaves and somewhat surpassing them, 3-8 carinate, the mouth constricted; rootlets whitish reddish or purple. 2.

2. Marginal leaf-cells quadrate and much larger than the others; rootlets whitish. *crenulata* Lindb.

Marginal leaf-cells about as large as the others. 3.

3. Branch leaves ovate or obovate, scarcely decurrent, half as large as the obliquely semi-circular or broadly ovate, decurrent stem leaves; fruit unknown. *biformis* Lindb.

Branch leaves similar to the stem leaves; fruit known. 4.

4. Rootlets reddish (claret-colored); leaves roundish oval; involucreal leaves closely appressed and connate with the lower third of the perianth, which is slightly exserted, obovate and narrowed to the 4-cleft mouth. *hyalina* Carrington.

Rootlets purple; leaves orbicular; involucreal leaves connate (more or less) with the small, subobovate perianth, which is slightly or not exserted, rooting at base and triquetrous above, but becoming 4-7 plicate. *crenuliformis* Lindb.

*Notothylas* Sulliv.

Thallus 5-15 mm. wide; capsule with a suture on each side; spores light yellowish-brown. *orbicularis* Sulliv.

Thallus small; capsule often without suture; spores dark-brown, a half larger. *melanospora* Sulliv.

*Odontoschisma* Dumort.

Underleaves mostly wanting; perianth subulate-fusiform, lacinate or ciliate; among mosses. *Sphagni* Dumort.

Underleaves broadly oval, entire and sub-denticulate; perianth close-connivent above at length bursting irregularly; on rotten wood. *denudata* Lindb.

*Pallavicinia* S. F. Gray.

Fruit arising from the costa, at first terminal, becoming dorsal; capsule cylindric, about 5 times longer than broad; involucre cup-shaped, short-lacerate. *Lyellii* S. F. Gray.

*Pellia* Raddi.

1. Thallus indistinctly costate, lobed and sinuate. Calyptra much longer than the involucre. Antheridia at the base of the involucre on the same thallus. *epiphylla* Raddi.



Thallus distinctly costate. Calyptra not surpassing the involucre. Antheridia on a separate thallus. 2.

2. Divisions of thallus broadly linear, the margin mostly undulate crisped. *endiviaefolia* Dumort.

Divisions of thallus, the early ones linear-oblong, the margins ascending and remotely sinuate, the later ones linear-pinna-tifid. *calycina* Nees.

*Plagiochila* Dumort.

1. Leaves with 3-12 large, spinulose and distant teeth; no under-leaves. *spinulosa* Dumort.

Leaves entire, repand or denticulate. 2.

2. Lower part of stem leafy to the base; underleaves 2-3 ceft, fuga-cious. 3.

Lower part of stem, forming a rhizome, bearing scales; no under-leaves; mouth of perianth ciliate. *asplenioides* Dumort.

3. Leaves entire or slightly repand; mouth of perianth crenulate. *interrupta* Dumort.

Leaves entire, the uppermost repand-denticulate; mouth of peri-anth denticulate. *porelloides* Lindenh.

*Porella* Dill.

1. Stems bipinnate; leaves more or less remote, ovate-oblong, lower lobe minute, flat, as long but not half as wide as the ovate-rectangular entire underleaves. *pinnata* L.

Stems mostly simply pinnate (or bipinnate in *P. platyphylla*); leaves mostly closely imbricate, round-ovate or ovate. 2.

2. Leaves sub-erect, the straight ventral margin strongly involute towards the apex; cells punctate-stelliform. *Sullivantii* Underw.

Leaves flat or more or less concave at base or somewhat convex, the margin decurved or curved upwards. 3.

3. Upper leaf-margin curved upwards and undulate, mostly entire; lower lobe reaching half of upper, hardly decurrent; under-leaves semi-circular with strongly reflexed margins, entire. *platyphylla* Lindb.

Upper leaf margin decurved, more or less denticulate; lower lobe smaller, long-decurrent; underleaves suborbicular or quadrate-oval or quadrate, dentate or ciliate serrate. 4.

4. Underleaves suborbicular or quadrate-oval, the margins undu-late and dentate; lower lobe acute, reaching  $\frac{1}{3}$  of upper and half as wide as the dentate underleaves. *dentata* Lindb.

Underleaves quadrate, the margins sparsely dentate; lower lobe oblong, obtuse, longer but narrower than the underleaves, both with strongly recurved and sparsely denticulate margins. *Thuja* Lindb.

*Preissia* Nees.

Thallus large, sparingly forking, increasing by joints, ends of lobes subcordate, with white pores above and dark purple scales below. Antheridia in a peduncled disk-like receptacle.

Dioecious or usually monoecious. *commutata* Nees.

*Ptilidium* Nees.

Stem subpinnate with short rootlets; perianth several times longer than the involucre. Antheridia in the base of closely imbricated leaves. Dioecious. *ciliare* Nees.

*Radula* Dumort.

1. Lower lobe small, rounded, more or less transversely adnate. *tenax* Lindb.

Lower lobe subquadrate, barely incumbent on the stem. 2.

2. Widely subpinnately branched; leaves imbricate, rounded; peri-anth obconic, compressed. Antheridia in the bases of 2-3 pairs of strongly imbricate tumid leaves. *complanata* Dumort.

Indeterminately branching; leaves somewhat remote, round-obovate; perianth clavate-obconic. Antheridia axillary on short lateral branches, arising near the terminal involucre.  
*obconica* Sulliv.

*Riccia* Micheli.

1. Terrestrial forms growing in rosettes or irregular dichotomous forms. Fruit immersed in the upper side of the thallus, mostly protuberant above. Thallus with or without air-cavities. 2.  
Aquatic plants floating in water or with its retreat rooting in mud and there fruiting. Fruit immersed in the lower side or the central groove of the thallus. Thallus with air-cavities. 12.
2. Thallus mostly without air-cavities. 3.  
Thallus with air-cavities communicating with the upper surface. 11
3. Thallus naked, without cilia and scales on the margin and underneath. 4.  
Thallus with scales underneath, not ciliate or more or less ciliate at the margin and apices. 7.
4. Spores small ( $60\mu$  or less). 5.  
Spores larger ( $75-95\mu$ ), dark fuscous with deep reticulations (about 8 across the convex surface); divisions of thallus narrow. *arvensis* Aust.
5. Thallus with wide divisions, thin and flat, with few rootlets; spores muriculate, spinulose. *tenuis* Aust.  
Thallus with narrow divisions and numerous rootlets. 6.
6. Thallus thin, fibrous-reticulate; spores obscurely muriculate. *Frostii* Aust.  
Thallus canaliculate above, carinate-thick-ened beneath; spores coarsely reticulate. (*fruitans*, L. var. *Sullivanti*, Aust.) *Huebeneriana* Lindenb.
7. Thallus with scales underneath, not ciliate. 8.  
Thallus more or less ciliate at the margin and apices. 10.
8. Scales and usually the thallus purple underneath; scales not exceeding the margin; spores light brown. *nigrella* D. C.  
Scales usually whitish; thallus green underneath. 9.
9. Scales reaching beyond the margin; spores light brown. *lamellosa* Raddi.  
Scales not reaching the margin; spores dark brown. (*sorocarpa* Bischoff) *minima* L.
10. Capsules usually in a single row; spores blackish, opaque, scarcely reticulated (*arvensis* Aust. var. *hirta* Aust.) *hirta* Aust.  
Capsules scattered chiefly near the base of the divisions (with a purple spot near them on the thallus); spores brown, reticulated with 7-8 areolae across the convex surface. *Lescuriana* Aust.
11. Upper surface of thallus strongly pitted, green or reddish to purplish; divisions of thallus rather broad, obtuse or often obcordate at the apex. *crystallina* L.  
Upper surface of thallus mostly smooth (except for the median groove), yellowish green; divisions narrow, linear, obcordate and convex. thickened at the apex. *lutescens* Schwein.
12. Thallus linear, dichotomous, floating or rarely terrestrial capsule protuberant from the lower surface. *fruitans* L.  
Thallus obcordate, floating or rarely terrestrial; capsule not protruding, at last exposed by a cleft in the central groove. *natans* L.

*Scapania* Dumort.

1. Lower leaf lobe equalling in size the upper or nearly so. 2.  
Lower leaf lobe (except those near the summit) about twice the size of the upper or 3-4 times its size. 3.

2. Leaf lobes roundish-obtuse and denticulate on outer margin; perianth much exceeding the involucreal leaves, denticulate.  
*subalpina* Dumort.  
 Leaf lobes broadly-ovate, obtuse or apiculate, entire; perianth small, entire. *glaucocephala* Aust.
  3. Lower lobes (except those near the summit) about twice the size of the upper. 4.  
 Lower lobes (except those near the summit) 3-4 times the size of the upper. 7.
  4. Leaves broader than long; upper lobes rounded or blunt. 5.  
 Leaves longer than broad; upper lobes more or less acute. 6.
  5. Leaves lax; lobes roundish, equal at the summit of the stem, entire or ciliate-denticulate; perianth oblong-incurved, nearly entire, twice as long as the involucre. *undulata* Dumort.  
 Leaves somewhat rigid, lobes rounded, submucronate, the lower appressed, the upper convex with incurved apex; perianth ovate, denticulate. *irrigua* Dumort.
  6. Lower and upper lobes ciliate-dentate, the upper acute; perianth densely ciliate. *nemorosa* Dumort.  
 Lower lobe coarsely dentate and with deep purple spur-like teeth on the keel, the upper roundish and less dentate; perianth usually dentate. *Oakesii* Aust.
  7. Lobes ovate, acute, serrate; perianth incurved, entire.  
*umbrosa* Dumort.  
 Lobes, the lower ovate, acute or bidentate, concave, the upper small and tooth-like; perianth oblong, 5-plicate, the mouth 5-dentate. *exsecta* Aust.
- Sphaerocarpus* Micheli.  
 Thallus orbicular, lobed, in small rosettes; the clustered inflated involucre (3 or 4 times as long as the capsule) mostly dispersed over its whole surface. *terrestris* Smith.
- Trichocolea* Dumort.  
 Stem pinnately decompose without rootlets; antheridia large, in the axils of leaves on terminal branches. Dioecious.  
*tomentella* Dumort.
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